Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
Wireless Operations in the 3650-3700 MHz Band	)	ET Docket No. 04-151
Rules for Wireless Broadband Services in the 3650-3700 MHz Band	)	WT Docket No. 05-96
Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band	)	ET Docket No. 02-380
Amendment of the Commission's Rules With Regard to the 3650-3700 MHz Government Transfer Band	)	ET Docket No. 98-237

To: The Commission

PETITION FOR PARTIAL RECONSIDERATION OF BRN PHOENIX, INC.

Ronald E. Quirk, Jr.
Venable LLP
575 7th Street, NW
Washington, DC 20004-1601
Tel: (202) 344-4000
Fax: (202) 344-8300

Its Attorney

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Summary

BRN Phoenix, Inc. ("BRNP") submits a partial petition for reconsideration regarding a recently released Report and Order ("Order") wherein the Commission adopted certain rules for licensing and operations of terrestrial wireless systems operating in the 3650-3700 MHZ ("3.65 GHz") band. Specifically, BRNP requests that the Commission: (a) designate the advanced antenna system method ("AAS Standard") using orthogonal frequency division multiple access ("OFDMA") modulation as described in Section 8.4.4.7 of the existing IEEE Standard 802.16-2004 as the contention-based protocol ("CPB") for fixed terrestrial systems operating in the 3.65 GHz band; and (b) permit the equivalent isotropically radiated power ("EIRP") to be increased as detailed in the main text of this Petition. As an alternative, BRNP requests that the Commission grant waivers to permit BRNP to use the AAS Standard for its fixed wireless broadband access systems that will operate in the 3.65 GHz band, and allow BRNP to increase the EIRP in conjunction with BRNP's use of the AAS Standard.

The AAS Standard meets the Commission's requirements for CPB by, inter alia, permitting multiple operators to have simultaneous access to the 3.65 GHz spectrum while utilizing null steering to remove co-channel interference generated by other operators' transmissions. Permitting the EIRP to be increased, as requested by BRNP, would allow for significantly greater range and capacity can be achieved, without any additional risk of interference to fixed earth stations. The increased range and capacity will have a significant impact on the data capacity that each carrier sharing the 3.65 GHz band can employ, and will significantly increase cell coverage areas, with accompanying positive impact on rural areas.

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PETITION FOR PARTIAL RECONSIDERATION
OF BRN PHOENIX, INC.

BRN Phoenix, Inc. ("BRNP"), by its attorney and pursuant to Section 1.429 of the Commission's Rules, 47 C.F.R. § 1.429, hereby requests reconsideration in part regarding the recently released Report and Order ("Order"),[1] wherein the Commission adopted rules for the nationwide licensing of terrestrial operations in the 3650-3700 MHz ("3.65 GHz") band.[2] BRNP requests reconsideration of the Order to the extent necessary to permit the Commission to designate the advanced antenna system method ("AAS Standard") using orthogonal frequency division multiple access ("OFDMA") modulation as described in Section 8.4.4.7 of the existing

[1] In the Matter of Wireless Operations in the 260-3700 MHz Band, Rules for Wireless Broadband Services in the 3650-3700 MHz Band, Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band, Amendment of the Commission's Rules With Regard to the 3650-3700 MHz Government Transfer Band, Report and Order and Memorandum Opinion and Order, FCC 05-56, ET Docket Nos. 04-151, 02-380, 98-237, WT Docket No. 05-96 (Rel. March 16, 2005).

[2] The Order was published in the Federal Register on May 11, 2005. Accordingly, this petition is timely filed. See 47 C.F.R. § 1.425.

IEEE Standard 802.16-2004, as the contention-based protocol ("CBP") for fixed terrestrial systems operating in the 3.65 GHz band.[3] Because BRNP's proposed AAS Standard is contained within an existing international IEEE Standard, it can be used by anyone.[4] There would be no additional costs involved in promulgating the AAS Standard as the CBP for 3.65 GHz service. This "open standard" is consistent with the public interest.

BRNP additionally requests that the equivalent isotropically radiated power ("EIRP") be permitted to be increased for operations in the 3.65 GHz band, which can be accomplished without increasing the probability of interference to fixed earth stations as compared to omnidirectional antennas restricted by the ERIP limits as currently defined by the Order. By increasing the EIRP when the AAS Standard is employed by 10*LOG ($BW_{Azimuth}/360$) (where $BW_{Azimuth}$ is the 3 dB beamwidth of the antenna pattern measured in the azimuthal plane), significantly greater range and capacity can be achieved without any additional risk of interference to fixed earth stations. The increased range and capacity will have a significant positive impact on the data capacity that each carrier sharing the 3.65 GHz band can employ, and will significantly increase cell coverage areas with accompanying positive impact on the economics of rural development. Therefore BRNP requests that the Commission allow increased EIRP as quantified above when the AAS Standard is employed.

In the alternative, BRNP requests that the Commission grant BRNP a waiver to use the AAS Standard for its fixed wireless broadband access system that will operate in the 3.65 GHz band, and grant a waiver for increased EIRP in conjunction with BRNP's use of the AAS Standard.

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[3] Some other selected sections of the IEEE 802.16-2004 Standard are cited herein, to illustrate additional features and benefits of BNRP's proposal.

[4] BRNP owns a patent regarding certain elements of the AAS Standard. BRNP is willing to waive the license fee to

I. Background

In the Order, the Commission acknowledges a critical need for rapid wireless broadband deployment in the U.S., and states that the actions it has taken regarding regulation of the 3.65 GHz band will provide opportunities for the rapid introduction of new wireless broadband services and technologies to all Americans, especially those living in rural areas.[5] To that end, the Commission determined that new terrestrial operations in the 3.65 GHz band should be subject to a streamlined licensing process, whereby they will be licensed on a nationwide, non-exclusive basis, and all licensees will register their fixed and base stations in a common database.[6]

The Commission further states that, due to the nature of this licensing system (e.g., shared spectrum), it is imperative that licensees engage in efficient and cooperative use of the 3.65 GHz spectrum in order to avoid harmful interference to other operators' systems.[7] Accordingly, the Commission will require that all terrestrial operations in the 3.65 GHz band use technology with CBP.[8] The Commission defines CBP as a protocol that "allow[s] multiple users to share the same spectrum by defining the events that must occur when two or more devices attempt to simultaneously access the same channel and establishing rules by which each device is provided a reasonable opportunity to operate."[9] The Commission determined that CBP should assist the rapid implementation of 3.65 GHz broadband wireless service by enabling indoor, as well as outdoor, terrestrial operations in the 3.6 GHz band, and allowing for flexible use of the 3.65 GHz

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permit fixed applications within this band only, but for not for other purposes.

[5] See Order at ¶¶ 2, 13.

[6] Id. at ¶ 16.

[7] Id.

[8] Id.

[9] Id. The FCC codified its CBP definition in a new rule, 47 C.F.R. § 90.7. The full definition includes a second sentence that reads: "Such a protocol may consist of procedures for initiating new transmissions, procedures for determining the state of the channel (available or unavailable), and procedures for managing retransmissions in the

band, including a variety of base-station-enabled mobile terrestrial operations.[10]

The incorporation of CPB will be a requirement of the certification process for equipment designed to operate in the 3.65 GHz band.[11] The Commission states that it would not specify a specific protocol as its required CBP, but rather will "leave it to the industry and standards bodies to determine appropriate protocols."[12]

The Commission lists certain important characteristics that CBP would need to incorporate if it is to be used in the 3.65 GHz band: (1) it would have to permit all users to have a reasonable opportunity to operate, so that no operator can block others' access to the spectrum;[13] and (2) it should have no unpredictable delays when a transmitter waits until a given channel is idle.[14] The Commission additionally states that advanced antennas can be used to create highly efficient spectrum network, and that flexibility regarding their use should be encouraged.[15]

II. Analysis

The Commission may grant a petition for reconsideration in a rulemaking proceeding which relies on facts not previously presented to the Commission if consideration of those facts would serve the public interest.[16] The AAS Standard has the characteristics delineated by the Commission as necessary for 3.65 GHz CPB, and will provide excellent quality of service for wireless broadband operators, while allowing the Commission's goals respecting use of the 3.65 GHz band, as stated in the Order, to be realized. Because the AAS Standard is contained within

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event of a busy channel." Id.
[10] Id.
[11] Id. at ¶ 58.
[12] Id.
[13] Id.
[14] Id. at ¶ 57.
[15] Id. at ¶ 53.
[16] See 47 C.F.R. § 1.429(b)(3).

an existing international IEEE Standard, adoption of it would permit the rapid implementation of wireless broadband operations in the 3.65 GHz band across the U.S., including rural areas.

Also, because sectorized and narrowbeam antennas reduce the probability of interference to fixed earth stations, their use should be encouraged.[17] An increase in the permitted EIRP will help to ensure that the use of such antennas is increased.

Accordingly, the public interest would be served by granting this Petition.[18]

A. The AAS Standard Meets the Commission's Requirements for CPB

The AAS Standard includes a "built in" CPB that would permit multiple operators to have simultaneous access to the 3.65 GHz spectrum while utilizing null steering to remove co-channel interference generated by other operators' transmissions. This simultaneous access/interference protection would be achieved by the AAS Standard using OFDMA modulation as described in Section 8.4.4.7 of IEEE Std. 802.16-2004.[19]

OFDMA subdivides a signal into sub-channels, with each sub-channel being allocated to a subscriber. Different sub-channels can then be combined from various carriers, which permits each subscriber to be treated separately independent of location, distance from the base station, interference and power requirements. Various modulations can be used for each sub-channel to provide improved coverage and throughput.

The sub-channel structure enables efficient duplexing. Because the 3.65 GHz band is not paired, duplexing will be accomplished via time division duplexing ("TDD").[20] The sub-

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[17] See Order at ¶ 47.
[18] See PinPoint Wireless, 19 FCC Rcd 2686, ¶¶ 6-8 (2004). The Commission granted reconsideration of an Order in a rulemaking proceeding in order to further its goal of deploying new wireless services to the public. Id.
[19] See IEEE 802.16 Standard for Local and Metropolitan Area Networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems, § 8.4.4.7 (Oct. 2004).
[20] Id. at § 8.4.4.1.

channels used for bandwidth request/grant employ interference cancellation to remove interference by other operators' systems.[21] For TDD operations, all base stations would be synchronized to a common time base (e.g., GPS), and would transmit and receive simultaneously according to a fixed duty cycle published in the FCCs licensing database. The timing sequence would be made available to the public.

By transmitting and receiving on the same time schedules, all the base stations and end-user devices can estimate and control the interference from other co-channel users.[22] Control and training signals enable estimation of interference.[23] Hence, by synchronizing transmission times and duty factors, a base station will not transmit while other base stations are receiving, thus eliminating interference among nearby or adjacent stations.

The 3.65 GHz band is logically divided into two 25 MHz bands. A base station may select one of the two sub-bands for operations, and sub-banding may be different from site to site. A base station or end user device may use only one channel at a time from any location. Sub-banding permits enhanced interference management, and prevents the blocking of transmission by co-channel operators by enabling either static or dynamic sub-band selection based upon the local interference environment and proximity of other competing base stations.[24]

Within the sub-band, TDD enables the AAS Standard. This achieves high spectral efficiency and permits simultaneous co-channel operation by multiple operators. As illustrated by thorough field testing,[25] the AAS Standard permits a highly improved spectral efficiency of nine b/s/Hz of true throughput. This compares to the true throughput of code division multiple

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[21] Id at §§ 8.4.4.7.1, 8.4.4.7.2.
[22] Id. at § 8.4.4.7.2.
[23] Id. at §§ 8.4.4.7.3, 8.4.4.7.4.
[24] Accordingly, the Commission should divide the 3.65 GHz band into two 25 MHz sections.
[25] See "Verizon Begins Testing BeamReach Network's Fixed Network Technology," Converge Network Digest,

access ("CDMA"), which is less than one b/s/Hz. The more than nine-fold increase in spectral efficiency translates into an over nine-fold increase in the "effective utility" of the 3.65 GHz spectrum made available under the Order relative to CDMA performance.

The AAS Standard also increases the number of logical request and grant sub-channels through multi-beam AAS, thus assuring contention-free control of the data sub-channels, i.e., no unpredictable transmission delays while waiting for an idle channel. Although contention is unlikely, a random back-off mechanism is included as a "back up" for the bandwidth request/grant sub-channels.[26]

B. The AAS Standard Provides for NLOS Coverage and Quality of Service

The AAS Standard allows for excellent non-line-of-sight ("NLOS") coverage, which is important for large-scale coverage. Sub-channeling enables the link budget to be balanced such that system gains are similar for both the up and down links. By concentrating the transmit power, the system gain can be increased, which can be used to: (a) extend the reach of a 3.65 GHz system; (b) overcome the building penetration losses; and (c) decrease the power consumption of indoor customer premises equipment ("CPE"). High system gain is critical for rural coverage. The AAS Standard can support end-user broadband end-user service rates in excess of 5 Mbps upstream and downstream.

The AAS Standard utilizes adaptive modulation, which permits a system to adjust the signal modification scheme depending on the signal-to-noise ratio ("SNR") condition of the radio link.[27] When the radio link is high in quality, the highest modulation scheme is used, giving the system more capacity. During a signal fade, the AAS Standard permits shifting to a lower

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Aug. 6, 2002.
[26] Id. at § 6.3.8.
[27] Id. at § 8.2.

modulation scheme to maintain the connection quality and link stability. Hence, time-selective fading is overcome. A key feature of adaptive modulation is that it increases the range that a higher modulation scheme can be used over, since the system can flex to the actual fading conditions, as opposed to having a fixed scheme that is budgeted for the worst-case conditions.

Error correction techniques are also inherent in the AAS Standard, which adds to its ability to provide strong transmissions.[28] Strong Reed Solomon Forward Error Correction ("FEC"),[29] convolutional encoding,[30] and interleaving[31] are used to detect and correct errors to improve throughput. These robust error corrections techniques help to recover errored frames that may have been lost due to frequency selective fading or burst errors. Automatic repeat request ("ARQ")[32] may be used to correct errors that cannot be corrected by FEC, by having the errored information resent. This significantly improves the bit error rate performance.

Additionally, the AAS Standard permits beam-forming,[33] which enables range boosting through focused beam energy. Beam-forming can limit a signal to the required direction of the receiver, like a spotlight. When receiving, the AAS Standard can be made to focus solely in the direction from where the desired signal is coming from. This permits the suppression of co-channel interference from other locations.

Accordingly, the AAS Standard, which permits robust NLOS transmission, has many implementation advantages that would enable operators to deliver wireless broadband to a wide range of customers, including those in rural areas. With essential features such as OFDMA

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[28] Id. at § 8.3.3.2.1.
[29] Id.
[30] Id. at § 8.4.9.2.
[31] Id. at § 8.2.
[32] Id. at § 8.2.1.2.
[33] Id. at § 8.3.6.4.

technology, sub-channeling, adaptive modulation, error correction, ARQ, beam-forming, and diversity, the AAS Standard will prove invaluable to 3.65 GHz operators wishing to provide quality and performance that rivals wireline technology. Because the AAS Standard is part of an already existing international standard, broadband wireless operators will be able to deploy standardized equipment with the right balance of cost and performance, choosing the appropriate set of features for their particular business models.

C. The AAS Standard Will Be Utilized for Fixed Applications

BRNP proposes that the AAS Standard should be used, at least initially, solely for fixed operations where the AAS Standard has been proven effective.[34] Moreover, the 802.16e standard for mobile operations in the 3.65 GHz band has yet to be ratified, and fixed operations will be deployed, at least initially. Consequently, the AAS Standard can be used with new equipment, which will help speed the implementation of wireless broadband throughout the U.S.

After the 802.16e standard is ratified and mobile wireless broadband operations in the 3.65 GHz band are proposed, BRNP or other interested parties may suggest that the AAS Standard be implemented for mobile applications as well. But, for the immediate future, BRNP proposes that the AAS Standard be implemented as CBP only for fixed operations. As long as the AAS Standard and duty cycle is maintained when mobility is added, deployed fixed systems can co-exist with mobility systems.

D. Increased EIRP for Advanced Antenna Systems

The Commission has observed that sectorized and phase array antennas could be used to create highly efficient networks and enable an application like a broadband LAN to serve a

[34] See "Verizon Begins Testing BeamReach Network's Fixed Network Technology," Converge Network Digest, Aug. 6, 2002

number of spatially separate clients from a single antenna site.[35] Such antennas allow systems to use spectrum more efficiently by making it possible to reuse a given frequency to communicate with different overlapping paths. Allowing flexibility encourages both new and novel antenna technologies that foster more intensive spectrum use.[36]

The Commission did, nonetheless, impose a general requirement that the EIRP for advances antennas should be limited to 25 Watts per 25 MHz, with the additional requirement that the aggregate power transmitted simultaneously on overlapping beams will have to be reduced such that the EIRP in the area of overlap does not exceed the limit for a single beam.[37]

Because the use of sectorized antennas at the base station and narrowbeam antennas on end-user devices reduces the probability of interference to fixed earth stations, BNRP requests a modification of Section 90.1321 of the Commission's Rules to encourage their use.[38] This modification maintains an "equal probability" of interference with respect to omnidirectional antennas. Specifically, BRNP requests that systems using sectorized or narrowbeam antennas should be permitted to increase EIRP by 10*LOG ($BW_{Azimuth}/360$) (where $BW_{Azimuth}$ is the 3 dB beamwidth of the antenna pattern measured in the azimuthal plane). Permitting this EIRP increase will serve the public interest by encouraging technologies that will protect fixed earth stations from interference.

III. Rule Waiver Request

BRNP proposes that the AAS Standard be adopted by the Commission as the CPB for terrestrial operations in the 3.65 GHz band. Alternatively, if the Commission requires additional

[35] See e.g., Order at ¶¶ 53-54.
[36] Id.
[37] Id.
[38] See 47 C.F.R. § 90.1321.

time to deliberate on the permanent standard for CBP, BRNP requests that it be granted a waiver of Section 90.203(o)(1)[39] to the extent necessary for BRNP to certify its equipment utilizing the AAS Standard as CBP, which would to enable it to commence deployment of a fixed wireless broadband system in the 3.65 GHz band. BRNP also requests waiver of Section 90.1321 of the Commission's Rules, to permit it to operate with an increased EIRP, when using the AAS Standard to maintain "equal probability" or less of interfering with fixed earth stations.

According to Section 1.925(b)(3) of the Commission's Rules,[40] the Commission may grant a request for waiver if it is shown that: (i) the underlying purpose of the rule would not be served by its application in a particular case, or (ii) in view of the unique or unusual factual circumstances of a given case application of the rule would be inequitable, unduly burdensome, or contrary to the public interest.[41]

Such unusual circumstances exist here. Because, according to new FCC Rule Section 90.203(o)(1), no 3.65 GHz wireless broadband equipment can be certified without a CPB,[42] service to the public will be inordinately delayed until a CPB is authorized. The Commission has granted rule waivers in order to speed deployment of new and innovative services to the public.[43]

The Commission's policy regarding its new rules for service in the 3.65 GHz band is to speed wireless broadband service to the public, especially those living in rural areas.[44] BRNP is completing its development of equipment that will be utilized to meet the Commission's goals,[45] but without an established CPB or waiver of the subject rule, BRNP cannot obtain certification of

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[39] 47 C.F.R. § 90.203(o)(1),(3).
[40] 47 C.F.R. 1.926(b)(3).
[41] Id.
[42] See 47 C.F.R. § 90.203(o)(1); Order at ¶ 58
[43] See PinPoint Communications, Inc., 14 FCC Rcd 6421, ¶¶ 8, 10 (1999).
[44] See Order at ¶¶ 2, 13.
[45] Due to the proprietary nature of BNRP's equipment design, BRNP will file, under separate cover, a Request for Confidentiality, pertaining to equipment description. If the Commission grants BRNP's Request for Confidentiality,

that equipment, which will delay service to the public[46] in contravention of the Commission's goals. Accordingly, the public interest will be served by grant of this Waiver Request, which will allow BRNP to speed wireless broadband service to the public.

BRNP also requests waiver of new FCC Rule Section 90.1321,[47] which contains the EIRP limits for antennas operating in the 3.65 GHz band. Because the Commission has placed a priority on preventing interference to fixed earth stations,[48] and sectorized and narrowbeam antennas reduces the probability of such interference, their use should be encouraged. Permitting increased EIRP will encourage such use, and BNRP requests that it waiver of the subject rule be granted to permit it to increase the power of those antennas.[49]

BRNP will provide a description of BNRP's subject equipment to the Commission.

[46] BNRP also requests that its duty cycle be published if the Commission grants this Rule Waiver Request. BNRP will send the specifics to the Commission along with the description of its equipment if its Request for Confidentiality is approved.

[47] 47 C.F.R. § 90.1231.

[48] See Order at ¶ 47.

[49] The requested increase in EIRP is the same as was stated in the previous section: 10*LOG (BW$_{Azimuth}$/360) (where BW $_{Azimuth}$ is the 3 dB beamwidth of the antenna pattern measured in the azimuthal plane).

IV. Conclusion

For all the foregoing reasons, BRN Phoenix, Inc. requests that the Commission designate the AAS Standard, based on AAS methods using OFDMA modulation as described in Section 8.4.4.7 in IEEE standard 802.16-2004 as the contention-based protocol for fixed terrestrial systems operating in the 3.65 GHz band, and permit the increase of EIRP for sectorized and narrowbeam antennas. Or, in the alternative, grant BRN Phoenix, Inc. a waiver to use the AAS Standard for its fixed wireless broadband access system, and increase the EIRP of its sectorized and narrowbeam antennas that will operate in the 3.65 GHz band.

Respectfully submitted,

BRN Phoenix, Inc.

By: _____
Ronald E. Quirk, Jr.
Its Attorney

Venable LLP
575 7th Street, NW
Washington, DC 20004-1601
Tel: (202) 344-4000
Fax: (202) 344-8300

Date: June 10, 2005